

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Patent Application of:)	Group Art Unit: 2815
Shunpei YAMAZAKI, et al.)	Examiner: Richards, N. Drew
Application No.: 08/520,079)	Confirmation No. 1321
Filed: August 28, 1995)	
For: SEMICONDUCTOR CIRCUIT FOR)	Date: December 11, 2006
ELECTRO-OPTICAL DEVICE AND)	
METHOD OF MANUFACTURING THE)	
SAME)	

RESPONSE AFTER FINAL

MAIL STOP AF

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

In response to the final Office Action mailed August 9, 2006, Applicants respectfully request reconsideration and allowance of the application in view of the following remarks.

Claims 73-116, 123-141, and 143-155 are pending in this application, of which claims 73, 80, 87, 93, 99, 105, 111, 123, and 129 are independent.

Claims 73-116, 123-141 and 143-155 stand rejected under 35 U.S.C. § 103(a) as being obvious over U.S. Patent No. 5,563,426 to Zhang et al. In addition, claims 73-86, 93-98, 105-110, 129-136, 138, 140, 144-148, 150 and 153 stand rejected under 35 U.S.C. § 103(a) as being obvious over Zhang in view of any one of JP 6-140631, JP 6-037112, U.S. Patent No. 5,273,921, or U.S. Patent No. 5,207,863. However, none of Zhang, JP 6-140631, JP 6-037112, U.S. Patent No. 5,273,921, or U.S. Patent No. 5,207,863, taken alone or in combination, discloses, suggest, or render obvious the invention as recited in 73-116, 123-141 and 143-155.

For example, the Examiner asserts, on page 3 of the Office Action, that no differences have been pointed out in the formation of the channel forming region of Zhang '426 and the channel forming region of the current pending claim in view of the currently pending specification, and that Zhang discloses a channel forming region having no grain boundary.

However, the steps of crystallizing an amorphous semiconductor film in the present application are different from steps of crystallizing an amorphous semiconductor film in Zhang. In this regard, the present application discloses that a sample is irradiated by laser light with the sample heated to 450 to 750°C to form monodomain regions 103, 104 and 105. (See page 18, line 6 to page 19, line 3, of the Specification, and Fig. 7). In specific, as is described on page 7, lines 4-17, the present application discloses that a region having no grain boundary (monodomain) is effectively formed by performing laser irradiation while heating, and it is important that the sample (the surface on which the monodomain region) that is formed is irradiated by laser light with 450 to 750°C.

In contrast, Zhang discloses that an amorphous semiconductor film 1 with island nickel regions 2 is annealed in a nitrogen atmosphere for 8 hours at 450 to 580°C. There is also an intermediate state in Zhang wherein nickel advance from the island nickel regions 2 near the edge to the center as nickel silicide 3A and portion 3 where the nickel had passed have become crystal silicon. (See Col. 12, lines 13-24). Thus, Zhang appears to be performing heating only when crystallizing an amorphous semiconductor film. Zhang does not perform laser irradiation while heating. As a result, the process performed by Zhang and the methods of the invention yield crystalline semiconductor films and thin film transistors having different characteristics.

As was stated in the Request for Reconsideration filed May 22, 2006, which is hereby incorporated by reference in its entirety, the inherency of the grain boundaries in the channel region of Zhang is clearly established by the teachings of U.S. Patent No. 6,011,275 to Ohtani et al. and U.S. Patent No. 5,894,137 to Yamazaki et al.

However, the Examiner asserts, on pages 40-41 on the Office Action, that Yamazaki and Ohtani both teach crystallization methods that employ a single heating or annealing step, and that

Zhang teaches the use of two separate heating or annealing steps. However, Ohtani discloses, on col. 10, lines 19-24, that a heat treatment is conducted at 500 to 630°C for 8 hours in a nitrogen atmosphere containing 3% hydrogen and little oxygen. Thus, Ohtani, like Zhang, only performs heating when crystallizing an amorphous semiconductor film. Similarly, Yamazaki discloses, at col. 7, lines 60-63, that a heating process is performed for 4-8 hours at a temperature of 500 to 700°C, in order to crystallize the amorphous silicon film 403. Thus, Yamazaki, like Zhang, only performs heating when crystallizing an amorphous semiconductor film.

Therefore, contrary to the Examiner's contentions, the inherency of the grain boundaries in the channel region of Zhang is clearly established by the teachings of Ohtani and Yamazaki. Accordingly, Zhang fails to teach or suggest a channel forming region having no grain boundary as recited in claims 73 and 80, or a monodomain region which contains no grain boundary as recited in claims 87, 93, 99, 105, 111, 123 and 129.

In addition, with respect to independent claim 73, the Examiner also asserts that Zhang must teach, in figures 1a – 1c, 2a – 2d and 4a – 4c, that the semiconductor island includes a spin density not higher than $1 \times 10^{17} \text{ cm}^{-3}$, because an identical spin density is a property that must be shared by products that result from two processes that are the same. However, as is explicitly stated above, the process of Zhang is not the same as the process of the invention. For example, Zhang does not perform laser irradiation while heating. Thus, because the process of Zhang is not the same as the process of the invention, Zhang does not explicitly or implicitly disclose or suggest a crystalline semiconductor island including a spin density not higher than $1 \times 10^{17} \text{ cm}^{-3}$.

Furthermore, on pages 39 to 40 of the Office Action, the Examiner asserts that even if grain boundaries are inherently present in the channel forming region of Zhang, it would have been obvious to one of ordinary skill in the art at the time of the invention to modify Zhang so that the channel regions are not formed in the same region as the crystal grain boundaries. In addition, on pages 40 to 41, the Examiner asserts that even though Zhang may not provide the motivation to combine by itself, the prior art as a whole provides motivation and suggestion for the proposed combination.

However, as described above, and contrary to the Examiner's repeated assertions, Zhang inherently includes grain boundary in the channel forming region. Thus, none of Zhang, JP 6-140631, JP 6-037112, U.S. Patent No. 5,273,921, or U.S. Patent No. 5,207,863, taken alone or in combination, disclose, suggest, or render obvious a spin density included in thin film transistor having no grain boundary (claim 73), a point defect included in thin film transistor having no grain boundary (claim 80), a mobility in thin film transistor having a monodomain region which contains no grain boundary (claims 87 and 93), or a concentration of hydrogen or halogen element included in thin film transistor having a monodomain region which contains no grain boundary (claims 99, 105, 111, 123, 129).

Accordingly, none of Zhang, JP 6-140631, JP 6-037112, U.S. Patent No. 5,273,921, or U.S. Patent No. 5,207,863, taken alone or in combination, disclose, suggest, or render obvious each and every feature of claims 73-116, 123-141 and 143-155. Accordingly, the rejections of claims 73-116, 123-141 and 143-155 under 35 U.S.C. § 103(a) as being obvious over Zhang and claims 73-86, 93-98, 105-110, 129-136, 138, 140, 144-148, 150 and 153 under 35 U.S.C. § 103(a) as being obvious over Zhang in view of any one of JP 6-140631, JP 6-037112, U.S. Patent No. 5,273,921, or U.S. Patent No. 5,207,863 should be reconsidered and withdrawn. Each of dependent claims 74-79, 81-86, 88-92, 94-98, 100-104, 106-110, 112-116, 124-128, 130-141, and 143-155 are also allowable based on their dependency on independent claims 73, 80, 87, 93, 99, 105, 111, 123, and 129, respectively, and also on their own merits.

In view of the foregoing, it is submitted that the present application is in condition for allowance and a notice to that effect is respectfully requested. If, however, the Examiner deems that any issue remains after considering this response, the Examiner is invited to contact the undersigned attorney to expedite the prosecution and engage in a joint effort to work out a mutually satisfactory solution.

Except for issue fees payable under 37 C.F.R. § 1.18, the Commissioner is hereby authorized by this paper to charge any additional fees during the entire pendency of this application including fees due under 37 C.F.R. §§ 1.16 and 1.17 which may be required,

including any required extension of time fees, or credit any overpayment to Deposit Account No. 19-2380. This paragraph is intended to be a **CONSTRUCTIVE PETITION FOR EXTENSION OF TIME** in accordance with 37 C.F.R. § 1.136(a)(3).

Respectfully submitted,
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